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(54) **Title of the Invention.** A solidification material capable of preventing dispersal

(57) **Abstract**

Objective. [To provide a solidification material] that has both excellent bending strength and improved ability to prevent dispersal, that can furthermore be used in a good environment

Composition. The solidification material of the present invention is an anti-dispersal ingredient and fibers selected from glass fibers, carbon fibers, natural fibers and organic synthetic fibers, used either singly or as a mixture of two or more types of fibers, mixed into a main ingredient. Cement, slaked lime, caustic lime and the like are used as the main ingredient. Anti-dispersal ingredients include compounds selected from glycol compounds, glycerin compounds and ether compounds or a mixture of two or more compounds, and they may be used singly, or a combination of two or more may be used. The amount added of these anti-dispersal ingredients is from 1% to 5% of the main ingredient; a combination of liquid paraffin with this anti-dispersal ingredient gives even better ability to prevent dispersal, and the ratio of the combination is from 1:3 to 3:1.

Scope of the Claims

Claim 1 A solidification material capable of preventing dispersal of dust comprising a mixture containing (a), (b) and (c) below:

(a) a main ingredient

(b) an anti-dispersal ingredient containing a compound selected from glycol compounds, glycerin compounds and ether compounds, either singly or as a mixture of two or compounds

(c) [fibers] selected from glass fibers, carbon fibers, natural fibers and organic synthetic fibers, either singly or as a mixture of two or more types of fibers

Claim 2 A solidification material capable of preventing dispersal of dust claimed in Claim 1, characterized in that the anti-dispersal ingredient is a mixture of at least one glycol compound, glycerin compound or ether compound and liquid paraffin.

Claim 3 A solidification material capable of preventing dispersal of dust claimed in Claim 2, characterized in that the combination in the anti-dispersal ingredient is a mixture of diethylene glycol and liquid paraffin.

Detailed Description of the Invention

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Field of Use in the Industry The present invention concerns a solidification material capable of preventing dispersal of dust, and more specifically concerns a solidification material capable of preventing dispersal of dust that, by means of the addition of fibers, has both excellent bending strength and improved ability to prevent dispersal, and that can furthermore be used in a good environment

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Previous Technology When ground improvement construction is carried out for roads and the like, asphalt paving is carried out after the road is dug up and the ground leveled, but when the road is dug up or the ground is leveled, it often happens that cement disperses [into the air] as dust and there are complaints from residential areas. Because of this, in locations bordering on shopping districts and homes, and even more particularly when the wind is strong, as in winter, road construction companies take a number of dust [suppression] measures. For example, when

construction is carried out in locations bordering on shopping districts and homes, dust [suppression] measures such as covering the construction area with tarpaulins to prevent dust from dispersing and putting the construction on hold when the wind is strong have been tried.

0003 In addition, fibers have been added to cement to prevent the cement from blowing up into the air as dust, and in recent years, polytetrafluoroethylene resins have been developed as a soil improving materials, and these have been mixed together with the cement, for example, that is the main ingredient to form solidification materials. The use of these solidification materials mixed with the soil produced at the construction site gives the excellent result that the production of dust is suppressed extremely well. In addition, Tokkai [Japan unexamined patent application] No. H05-140543 describes the use of dust preventing agents containing peptized fibers and a dispersion medium such as an organic solvent, such as toluene or gasoline, or a mineral oil, such as spindle oil, and these are added to Portland cement, which is [then] used in ground improving agents as a no-dust cement.

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Problems the Invention Attempts to Solve However, the dust prevention effect on dust with previous fiber-added cements has not been adequate, and while, as described above, the effectiveness of solidification materials containing polytetrafluoroethylene resin is excellent, economically, they have the disadvantage of being expensive. Furthermore, the dust preventing agents described in Tokkai No. H05-140543, have the disadvantage that because the volatile component, such as an organic solvent, such as toluene and gasoline, or mineral oil, such as spindle oil, which is the preferred dispersion solvent for preventing dust, is used as the main component, volatilization of these [solvents] results in characteristic odors spreading into the surrounding area, and this is environmentally undesirable.

0005 Accordingly, the inventors of the present invention, firstly, to find a soil improver that is both effective in preventing dispersal of dust and can be obtained cheaply, tested and examined a variety of compounds and as a result discovered the fact that alcohol compounds, particularly glycol compounds, ether compounds and liquid paraffin are effective, and submitted Japan patent application No. H04-240104. Furthermore, as a result of continuing research on how to best make soil improvers with good bending strength that, taking pollution into account, are environmentally desirable, the inventors of the present invention discovered that they can be obtained by adding fibers to a mixture of a compound or two or more compounds selected from glycol compounds, glycerin compounds and ether compounds with liquid paraffin; and this led to the present invention. Consequently, the objective of the present invention is to provide a solidification material with both excellent bending strength and improved ability to prevent dispersal, that can furthermore be used in a good environment.

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Measures by which the Problems are Resolved The above objective of the present invention is attained by means of the following inventions:

(1) A solidification material capable of preventing dispersal of dust comprising a mixture containing (a), (b) and (c) below:

(a) a main ingredient

(b) an anti-dispersal ingredient containing a compound selected from glycol compounds, glycerin compounds and ether compounds, either singly or as a mixture of two or compounds

(c) [fibers] selected from glass fibers, carbon fibers, natural fibers and organic synthetic fibers, either singly or as a mixture of two or more types of fibers

(2) A solidification material capable of preventing dispersal of dust claimed in Claim 1, characterized in that the anti-dispersal ingredient is a mixture of at least one glycol compound, glycerin compound or ether compound and liquid paraffin.

(3) A solidification material capable of preventing dispersal of dust claimed in Claim 2, characterized in that the combination in the anti-dispersal ingredient is a mixture of diethylene glycol and liquid paraffin.

0007 In the explanation of the present invention in detail below, the solidification material capable of preventing dispersal of dust in the present invention is a mixture of (a) a main ingredient, (b) a single compound or a mixture of two or more types of compounds selected from glycol compounds, glycerin compounds and ether compounds as the anti-dispersal ingredient, and (c) [fibers] selected from glass fibers, carbon fibers, natural fibers and organic synthetic fibers, either singly or as a mixture of two or more types of fibers; it is what is called a solidification material capable of preventing the dispersal of cement and the like as dust, and by means of the aforementioned composition, it has the advantageous results of both excellent bending strength and improved ability to prevent dispersal, and it can furthermore be used in a good environment. In addition, the further addition of liquid paraffin to the aforementioned anti-dispersal ingredient results in an even greater ability to prevent dispersal of dust, in addition to making its use possible in a good environment.

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Cement, slaked lime, caustic lime and the like can be used as the main ingredient (a) used in the present invention. In addition, for the anti-dispersal ingredient (b) used in the present invention, a glycol compound, a glycerin compound or an ether compound (referred to below as compound[s] of glycol, etc.) can be used, and liquid paraffin may be added to one or a plurality of these. Examples of glycol compounds include ethylene glycol, diethylene glycol, propylene glycol and triethylene glycol; examples of ether compounds include ethylene glycol dimethyl ether, ethylene glycol diethyl ether and triethylene glycol monomethyl ether; and examples of glycerin compounds include glycerin; and these may be used singly or a combination of two or more may be used.

0009 The amount added of these compound[s] of glycol, etc., is from 1% to 5% of the main ingredient, and from 2% to 4% is preferred. Addition of less than 1% of these compound[s] of glycol, etc., is undesirable because the effect on the dispersal of dust is weak, and amounts in excess of 5% are economically undesirable. In addition, the liquid paraffin is a relatively light lubricating oil fraction, for example, spindle oil fraction, preferably a highly refined hydrocarbon oil, and comprises mainly alkyl naphthenes. The amount added of liquid paraffin is from 1% to 5% of the main ingredient, and from 2% to 4% is preferred. Addition of less than 1% of liquid paraffin is undesirable because the effect on the dispersal of dust is weak, and amounts in excess of 5% are environmentally undesirable because it evaporates, and it is furthermore economically undesirable.

0010 Furthermore, when compound[s] of glycol, etc., are used mixed together with liquid paraffin, even more effective prevention of dust dispersal can be obtained, and this is when they are mixed together in a ratio of from 1:3 to 3:1, preferably 3:1.

0011 [Fibers] selected from glass fibers, carbon fibers, natural fibers and organic synthetic fibers, either singly or in the form of a mixture of two or more types of fibers, are used as the fibers (c) used in the present invention. Examples of natural fibers include pulp, cotton, linen/hemp and silk; organic synthetic fibers include polypropylene fibers, vinylon fibers, acrylic fibers and aramid fibers. Organic synthetic fibers are preferred, and polypropylene fibers are particularly preferred. The length of these fibers is preferably 15 mm or less, and from 1 mm to 10 mm is further preferred. When [the fibers] are shorter than 1 mm, they do not contribute to good bending strength. In addition, [fiber lengths] exceeding 15 mm are undesirable, because they have poor dispersability with respect to the compound[s] of glycol, etc., and this adversely affects the quality [of the product].

0012 In addition, the amount of fibers added is from 0.1 to 5.0 weight percent of the compound[s] of glycol, etc., preferably from 0.5 to 5.0 weight percent, and more preferably from 1.0 to 5.0 weight percent. If fibers are added in amounts less than 0.1 weight percent, good bending strength cannot be obtained. In addition, when the amount of fibers added exceeds 5.0 weight percent, not only do problems arise because the fibers cannot be mixed uniformly enough into the main ingredient, but it is also economically disadvantageous.

0013 In addition, the solidification material capable of preventing dispersal of dust may be [prepared] in advance by adding the compound[s] of glycol, etc., and the fibers either sequentially or simultaneously, or by adding a mixture in which the fibers are dispersed in the compound[s] of glycol, etc., into the main ingredient; or, at the time of use, on site, by adding the compound[s] of glycol, etc.,[1] either sequentially or simultaneously, or by adding a mixture in which the fibers are dispersed in the compound[s] of glycol, etc., to the main ingredients to form a solidification material when it is used on site; but the former, in which the compound[s] of glycol, etc., are added either sequentially or simultaneously, or a mixture wherein the fibers are dispersed in the compound[s] of glycol, etc., is added and mixed into the main ingredient in advance, is preferred. These methods are also applicable in the case of mixtures of compounds of glycol, etc., with liquid paraffin, and in this case the liquid paraffin may be added at any point in the addition of the other components into the main ingredient, but adding it in advance to the compound[s] of glycol, etc., is preferred.

0014 The solidification material capable of preventing dispersal of dust used in the present invention is normally mixed with soil produced from the site to improve the roadbed and to prevent dust from dispersing when paving roads. However, it should not even be necessary to state that its application is not limited to this, and it can also be used in other similar applications.

0015 Operation of the Invention In the present invention, the bending strength of a solidification material can be increased by the addition of fibers to said solidification material capable of preventing dispersal of dust, and as a result, sufficient effectiveness in preventing dispersal can be obtained. In addition, because the compound[s] of glycol, etc., have little volatility, there are no issues such as odors given off by these compounds.

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Working Examples The present invention is described more specifically below using working examples, but the present invention is not limited by these working examples.

0017 Working Example 1

Using Stabilite M15 (Mitsubishi Materials Corp., a cement-based solidification material) as the solidification material, 3 weight percent of diethylene glycol was added to said Stabilite M15 and mixed, and various [types of] fibers were added to each. The fibers were added in an amount of 0.5 weight percent of the mixture and mixed. The solidification materials obtained in this manner were dropped from a height of 70 cm when the wind velocity was 4 m/sec, and the dispersal rate was represented as a percentage, taking the amount of Stabilite M15 that was dispersed 1 m or more from the dropping point as 100%.

0018

Table 1

	Classification	Solidification material	Type of fibers	Dispersal rate (%)
1	Comparison Example	Stabilite M15	–	100
2	Invention	Stabilite M15 + 3% diethylene glycol	Pulp fibers	20
3	Invention		Polypropylene fibers	18
4	Invention		Glass fibers	33
5	Invention		Carbon fibers	13

0019 It can be seen clearly from Table 3 that in the Invention [samples], it is possible to obtain a good solidification material with a low dispersal rate compared to that of the Comparison Example. In particular, the [results for the material] with polypropylene fibers were excellent, similar to those [for the materials] with pulp fibers and carbon fibers and the like.

0020 Working Example 2

Using Stabilite M15 (Mitsubishi Materials Corp., a cement-based solidification material) as the solidification material, 3 weight percent of diethylene glycol was added to said Stabilite M15 and mixed, and polypropylene fibers were subsequently added to said mixture at varying rates of 0.5 weight percent, 1.0 weight percent, 2.0 weight percent, 5.0 weight percent and 6.0 weight percent to make solidification materials. The dispersal rates of the solidification materials obtained in this way were represented by the same method described in Working Example 1, and are shown in Table 2.

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Table 2

No.	Classification	Solidification material	Percent polypropylene fibers added (%)	Dispersal rate (%)
1	Comparison Example	Stabilite M15	–	100
2	Invention	Stabilite M15 + 3% diethylene glycol	0.5	18
3	Invention		1.0	16
4	Invention		2.0	14

5	Invention		5.0	10
6	Comparison Example	Stabilite M15	6.0	10

0022 It can be seen clearly from Table 2 that in the Invention [samples], the dispersal rate decreases as the percentage of fiber added increases, and it is possible to obtain good effectiveness in preventing dispersal. It can also be seen that if the amount of fibers added is 6.0 weight percent or more, there is hardly any change in effectiveness in preventing dispersal, while the amount of fibers added increases, which is uneconomical.

0023 Working Example 3

Soil samples of clay (water content 68.2%, weight per unit volume 1.531 g/cm^2) were prepared. On the other hand, 3 weight percent of diethylene glycol was added to the solidification material Stabilite M15 (Mitsubishi Materials Corp., a cement-based solidification material) and mixed, and various [types of] fibers were added to each. The fibers were added in an amount of 2.0 weight percent of the mixture and mixed. After 150 kg/m^3 of these solidification material mixtures were added to the aforementioned clay to make 4 x 4 x 16 cm test materials, the test materials were cured for 7 days in a humidor. The bending strength of the test materials obtained was measured. The results are shown in Table 3.

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Table 3

No.	Classification	Solidification material	Type of fibers	Bending strength (kgf/cm^2)	Relative strength (%)
1	Comparison Example	Stabilite M15	–	1.87	100
2	Invention	Stabilite M15 + 3% diethylene glycol	Pulp fibers	1.95	104
3	Invention		Polypropylene fibers	2.06	110
4	Invention		Glass fibers	2.09	112
5	Invention		Carbon fibers	2.13	114

0025 It can be seen clearly from Table 3 that in the Invention [samples], each of the solidification materials to which fibers were added had good bending strength compared to the Comparison Example. The bending strength value for the [material] to which polypropylene fibers were added was greater than 2.00, at 2.06, and it can be seen to be excellent, similar to the [material] to which carbon fibers were added.

0026 Working Example 4

Solidification materials were made in the same way as in Working Example 1, except that instead of the diethylene glycol described in Working Example 1, a mixture of 3 weight percent of diethylene glycol and 1 weight percent of liquid paraffin (liquid paraffin for industrial use, type 70, Chuo Kasei Co., Ltd.) was used, and the dispersal rates were determined. The results obtained are shown in Table 4.

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Table 4

	Classification	Solidification material	Type of fibers	Dispersal rate (%)
1	Comparison Example	Stabilite M15	–	100
2	Invention	Stabilite M15 + 3% diethylene glycol + 1% liquid paraffin	Pulp fibers	14
3	Invention		Polypropylene fibers	12
4	Invention		Glass fibers	15
5	Invention		Carbon fibers	10

0028 Working Example 5

Solidification materials were made in the same way as in Working Example 1, except that, for the fibers described in Working Example 1, polypropylene fibers and carbon fibers, and polypropylene fibers and pulp fibers were added to each [sample] in ratios of 1:1, and the dispersal rates were determined. The results for both were good: the dispersal rate for polypropylene and carbon fibers was 14, and for polypropylene and pulp fibers, 18.

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Effectiveness of the invention Because a glycol compound, a glycerin compound or an ether compound and fibers are added to the solidification materials capable of preventing dispersal of dust of the present invention, they are, of course, effective in preventing dispersal, and excellent bending strength can also be obtained, resulting in improvement of their effectiveness in preventing dispersal. In addition, the addition of a glycol compound, a glycerin compound or an ether compound, liquid paraffin and fibers makes it possible to obtain a low dust solidification material with even better bending strength and ability to prevent dispersal; and the use of this results in even better effectiveness in preventing dispersal of dust during construction such as road paving.

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